## REMARKS

Claims 1-11 and 14-20 are pending in the present Application. Claim 1 has been amended, Claims 2 and 3 have been canceled, no new claims have been added, and Claims 17-19 remain withdrawn, leaving Claims 1, 4-11, and 14-16 for consideration upon entry of the present Amendment.

Claim 1 has been amended to include the limitations of Claims 2 and 3, canceled herewith. No new matter has been introduced with these amendments.

Reconsideration and allowance of the claims are respectfully requested in view of the following remarks.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-11 and 20 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 3,666,506 ("Cowan") further in view of U.S. Patent No. 3,762,935 ("Leach"), and U.S. Patent No. 4,758538 ("Satoh"). Applicants respectfully traverse this rejection.

Cowan discloses a batch composition that may be cellulated at low temperatures, which includes 50 wt% or more of rock, such as volcanic ash, intermediate weathered products of volcanic ash, and clays; 10-20 wt% of a flux; and 0.1-2.0 wt% of carbon based on decomposition of a cellulating agent, such that the batch is composed of 50-80% silica, 10-25% alumina, 10-20% $R_2O$ (where R is an alkali metal cation), and 0-10% impurities. Cowan, Col. 2, lines 26-33; Col. 3, lines 44-50; Col. 5, lines 13-15; Col. 6, lines 15-19. Clay materials including montmorillonite and Illite are disclosed. Cowan, Table I. The flux must be at least 20% by weight NaOH or $Na_2SiO_3$, and at least 60% $Na_2O$. Cowan, Col. 2, lines 49-53. The cellulating agent is an organic material that decomposes to produce gas and carbon, where preferred cellulating agent is sodium acetate. Col. 2, lines 58-61. It is essential that the ratio of silica to alumina be *about* 3:1 to 7:1 (Note: see Wyoming Bentonite in Table 1 with a silica to alumina ratio of 2.8), that the total flux content is 10 to 20 wt%, and that impurities including CaO, MgO, BaO, and $Fe_2O_3$ should not exceed 10%, all based on the oxide. Closed cell pores are disclosed, where the pores have a uniform size, do not exceed ¼" in diameter, and where the product has a density of 0.15 to 0.65 g/cc. Cowan, Col. 8, lines 1-20.

Leach discloses a closed or open cell foamed material. Col. 3, lines 38-40. It is described that the composition for making the article comprises aluminum hydroxide, aluminum oxide, glass frit, bentonite, metal powder, and phosphoric acid. Col. 3, lines 8-19. The glass frit comprises 24-36% silica, 10-25% $B_2O_5$, 15-26% $TiO_2$, 15-20% $Na_2O$, and 3-7% $K_2O$, 4-5% $Li_2O$, 1-11% BaO, up to 3% $Sb_2O_3$, up to 10% ZnO, and up to 3% Fe. Col. 8, lines 42-50.

Satoh discloses a foamed ceramic body of at least 90 wt% of a *ceramic* composed of 60 to 80 wt% silica, 5 to 15 wt% alumina, 8 to 14 wt% of alkali metal oxide, and 1 to 10 wt% of calcium oxide (CaO). Satoh, Abstract (*emphasis added*).

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). "A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.,* 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must "identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does." *Id.*

Claim 1 as amended is directed to a super light weight ceramic panel having closed pore structures produced by trapping carbon dioxide gas and oxygen gas, which is formed from a composition containing 90 to 98% by weight of an expandable clay mineral, 1 to 5% by weight of glass, and 1 to 5% by weight of silicon carbide, wherein the expandable clay mineral consists essentially of 61.5 to 70% by weight of $SiO_2$, 15 to 20% by weight of $Al_2O_3$, 1 to 5% by weight of $Fe_2O_3$, 2 to 4% by weight of CaO, 1 to 3% by weight of MgO, 0.5 to 1.5% by weight of $K_2O$ and 2 to 5% by weight of $Na_2O$, and wherein the closed pore has a pore density of 343 to 1000 pore $cm^3$ and wherein the closed pore has a pore volume of 74 to 89% relative to the total volume of the panel.

One of the characteristic features of the super lightweight ceramic panel of the subject invention is that the closed pore has a pre density of 343 to 1000 pores per cubic centimeter and a pore volume of 74 to 89 percent relative to the total volume of the panel. Due to such structure and physical properties of the closed pores, the ceramic panel of the subject invention is super

lightweight and strong, and has superior physical properties such as high water resistance, flame retardancy, heat insulation and far infrared radiation rate (see Specification, p. 4., lines 28-34).

Applicants have found that the composition of Claim 1 unexpectedly provides a super lightweight ceramic panel having a pore density of 343 to 1000 pores per cubic centimeter and a pore volume of 74 to 89%.

In the OA it is stated that Cowan as modified by Leach and Satoh, or Kurz as modified by Leach, Satoh, and Cowan, each uses the same ceramic composition and the same technique for forming a ceramic panel as claimed in Claim 1, i.e., firing and foaming the clay composition at a temperature of 1100 to 1200°C and the resulting ceramic panel has a closed cell structure having a porosity falling within the claimed range in Claim 1. However, none of the cited references either alone or in combination, teaches or suggests the came ceramic composition claimed in Claim 1, and therefore there is no suggestion or incentive .

Regarding the combination of Cowan as modified by Leach and Satoh, Cowan discloses a batch composition which may be cellulated at low temperatures, without restraint; and where in the shape of the cellulated body maintains the configuration of the preformed batch material Cowan, Col. 2, lines 26-29. The principal batch ingredients include 1) at least one type of mineral such as clays, 2) an added flux, and 3) a cellulating agent. Cowan, Col. 2, lines 29-33. Though Cowan discloses a clay present in at least 50% by weight of the total batch, Cowan also discloses that the flux is present in an amount of about 10 to 20 wt% based on batch weight and in addition, the amount of *carbon* available for expanding is 0.1 to 1 wt% where for the preferred organic expanding agent, 1 wt% of sodium acetate is required to provide 0.15 wt% of carbon. Cowan, Col. 5, lines 13-16 and Col. 6, lines 15-20. Consequently, the amount of clay in Cowan is less than 90 wt% of the batch (i.e., can be no more than 100 wt% clay – 10 wt% flux – 0.1wt% carbon (where carbon black or graphite is used) = 89.9 wt% at the most), whereas the instant claims claim a composition having 90 to 98 wt% expandable clay mineral as claimed in Claim 1. One will therefore appreciate that the disclosed range of clay in Cowan does not overlap with that of Claim 1, and Cowan neither discloses nor suggests using a higher amount of expandable clay mineral as it is further disclosed that the ceramic panel made from the composition containing 90 to 98% by weight of an expandable clay mineral.

Leach discloses a foamed in place article having a high dimensional stability at extremes of heat and cold, good insulating properties and high tensile strength (Abstract). It is disclosed

that the composition for making the article comprises 0 to 50 wt% aluminum hydroxide, 0 to 50 wt% of aluminum oxide, 1 to 20 % glass frit, 0.5 to 5% by weight bentonite, 0 to 0.25 wt% metal powder, and 35 to 60% of phosphoric acid (Claim 4). Even though Leach mentions a foamed ceramic material comprising a glass frit in an amount of 1 to 20 wt%, Leach neither discloses nor suggests the ceramic panel made from the composition containing 90 to 98% by weight of a expandable clay mineral having a specific composition according to Claim 1. Leach therefore fails to remedy the deficiencies of Cowan.

Satoh discloses a process for producing a foamed ceramic body which comprises 100 parts by weight of a powdery mixture of 75 to 90 wt% volcanic material, 5 to 15 wt% of an alkali metal oxide or compound which forms a an alkali metal oxide on heating and 2 to 10wt% of CaO or a compound which forms CaO on heating uniformly with 0.1 to 1 part by weight of a blowing agent, and heating the mixture to a temperature of 800 to 1100°C (Abstract). In Satoh, examples of the volcanic materials are liparite, rhyolite including "koukaseki" which occurs naturally in Niijima Island of Japan, granite and quartz trachyte, and "shirasu". Satoh, Col. 3, lines 31-34. One skilled in the art will appreciate that each of these exemplified compounds are compositionally and morphologically different from the expandable clay mineral claimed in Claim 1, and are therefore not equivalent. Satoh therefore fails to remedy the deficiency of Cowan and Leach, and therefore the combination fails to teach all elements of the instant claims.

As to the disclosure of 75 to 90 wt% of volcanic material in Satoh, there is no suggestion or incentive to increase the amount of clay in Cowan based on the disclosure of Satoh, because to do so would push the amount of clay outside the ranges disclosed in Cowan. There is therefore no suggestion or incentive that would lead one skilled in the art to modify Cowan with Leach and Satoh to have an amount of expandable clay mineral of 90 to 98 wt%. Also, substituting SiC as disclosed in Satoh for carbon black or graphite expanding agent of Cowan, to reflect the limitations of the instant Claims, would further decrease the amount of expandable clay mineral used in Cowan according to the definition of 0.1 to 1 wt% of blowing agent based on the amount of expandable carbon, and therefore combining Satoh with Cowan and Leach still fails to teach the claimed amount of expandable clay mineral as claimed in Claim 1, and fails to provide a suggestion or incentive that would lead one skilled in the art to modify the combination of Cowan, Leach, and Satoh to provide the missing limitation.

There is also no disclosure of the claimed limitations for the super lightweight ceramic panel, i.e., a pore density of 343 to 1000 pores per cubic centimeter and a pore volume of 74 to 89%, found in the combination of Cowan, Leach, and Satoh. Cowan discloses closed cell pores of up to ¼ inch diameter and densities of 0.15 to 0.65 g/cc, but is silent as to either pore density or the pore volume (i.e., total free volume based on the pores) as claimed in Claim 1. One skilled in the art will appreciate that Leach and Satoh fail to remedy this deficiency. Applicants have unexpectedly and specifically found that the composition claimed in Claim 1, having 90-98 wt% of an expandable clay mineral, provides this pore density and free volume. Nothing in Cowan, modified with Leach and Satoh, suggests that the required pore density would be obtained as a result of combining Cowan, Leach, and Satoh, further modified to have a higher proportion of expandable clay of 90-98 wt% as claimed in Claim 1, and thus there is no suggestion to combine Cowan with Leach and Satoh to achieve the desired pore density and free volume of Claim 1.

Therefore, the combination of Cowan, Leach, and Satoh fails to disclose all elements of instant Claim 1, and fails to suggest a ceramic panel having the composition or properties claimed in Claim 1, and thus the combination does not render Claim 1 or its dependents unpatentable. Reconsideration and allowance of Claim 1 and its dependent claims is therefore respectfully requested.

Claims 14 and 15 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Cowan in view of Leach and Satoh, and further in view of U.S. Patent No. 3,727,838 ("Bergh").

Claim 16 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Cowan in view of Leach and Satoh, and further in view of Romanian Patent No. 114015 ("RO '015").

Neither Bergh nor RO '015 provides the missing limitations missing in the combination of Cowan, Leach, and Satoh, and therefore modification of the combination with either Bergh or RO '015 fails to remedy the deficiencies of Cowan, Leach, and Satoh as applied to Claim 1, from which Claims 14-16 depend. Therefore, the combination does not render Claim 1 or its dependents unpatentable. Reconsideration and allowance of the claims are therefore respectfully requested.

Claims 1-11 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 4,071,369 ("Kurz") in view of Leach, Satoh, and Cowan.

Kurz discloses a method for manufacturing porous ceramic products by mixing ceramic material which 1-35% of a fly dust containing silica and metal oxides and having a large specific surface area. Col. 4, lines 49-52. The fly dust contains a high proportion (75-92%) of silica ($SiO_2$) and different metal oxides such as MgO, $Al_2O_3$, and $Fe_2O_3$, and a specific fly dust having a composition of 70-75% $SiO_2$, 12-15% $Al_2O_3$, and 6-10% alkali. Col. 1, lines 31-45 and 57-59; Col. 3, lines 57-60. In Example 2, 0.2 % by weight of SiC (silicon carbide) has been added as an oxidizing agent. Col. 5, line 43 in Example 2. Kurz discloses a clay having a composition of 17-47% $Al_2O_3$, 50-70% silica, 10-20% alkali, and "some organic materials". Col. 5, lines 27-33. Kurz states that "*almost* all types of know clays" can be expanded by mixing with a homogeneous siliceous powder (i.e., "alkali", which is a material having the composition of a fly dust), and that oxidizing agents such as SiC can be added when bound to each grain of the "powder" to allow for a simultaneous reaction and uniform pore distribution. Col. 3, line 65 to Col. 4, line 6; *emphasis added.*

In the OA it is stated that the combination of Kurz as modified by Leach, Satoh, and Cowan, provides the same ceramic composition and the same technique for forming a ceramic panel as claimed in Claim 1, i.e., firing and foaming the clay composition at a temperature of 1100 to 1200°C and the resulting ceramic panel has a closed cell structure having a density falling within the claimed range in Claim 1. Applicants respectfully disagree, and assert that none of the cited references, either alone or in combination, teaches or suggests the came ceramic composition claimed in Claim 1.

As to the combination of references, Kurz fails to disclose the use of 90 to 98 wt% of an expandable clay mineral, and as argued above, neither Cowan, Leach, nor Satoh remedies this deficiency. Kurz discloses that the composition includes 1 to 35 w% of fly dust relative to the clay, but is silent as to the amount of clay present in the ceramic as a whole. Kurz, Col. 4, lines 49-51. In Example 1 of Kurz, 100 pars by weight clay were mixed with 10 parts by weight of a fly dust and then 10 parts by weight of 20% sulfate waste liquor. Accordingly the amount of clay used was 100/120 parts = 83 wt% by weight in Example 1. In Example 2, 30 parts by weight of clay were mixed with 70 parts by weight of other materials and 0.2 parts by weight of

SiC included as an oxidizing agent. Accordingly, Kurz neither discloses nor suggests nor exemplifies inclusion of 90 to 98 wt% of the expandable clay mineral of the instant invention.

Kurz modified with Leach, Satoh, and Cowan, as described above, therefore, fails to suggest that the required pore density would be obtained as a result of combining these references, further modified to have a higher proportion of expandable clay of 90-98 wt% as claimed in Claim 1, and therefore there is no suggestion to combine Kurz, Leach, Satoh, and Cowan to achieve the desired pore density and free volume.

Further, Kurz states that "it is not believed that a clay is known which contains all the constituents necessary of an optimal process of foaming". Kurz, Col. 3, lines 31-33. Kurz further requires fly dust to be added to the clay, where it is stated "homogeneously mixing therewith a siliceous powder of high specific surface area (above 20 $m^2/g$)", i.e., fly dust, and that "the major additive should always be a fly dust having an exceptionally high specific surface area and containing both metal oxides and carbon." Kurz, Col. 3, lines 56-58 and Col. 4, lines 30-34. Claim 1 does not require addition of fly dust with a high specific surface area to provide the desired pore density and free volume. Note that the omission of an element and retention of its function is an indicia of unobviousness. *In re Edge*, 359 F.2d 896, 149 USPQ 556 (CCPA 1966) (Claims at issue were directed to a printed sheet having a thin layer of erasable metal bonded directly to the sheet wherein said thin layer obscured the original print until removal by erasure. The prior art disclosed a similar printed sheet which further comprised an intermediate transparent and erasure-proof protecting layer which prevented erasure of the printing when the top layer was erased. The claims were found unobvious over the prior art because the although the transparent layer of the prior art was eliminated, the function of the transparent layer was retained since appellant's metal layer could be erased without erasing the printed indicia.). MPEP 2144.04 (II)(B).

Though Applicants note that the Examiner has not provided Kurz as an anticipatory reference, and therefore there is no direct comparison possible between the composition of the instant claims and the hypothetical composition presented by the Examiner based on the composition of Kurz modified with Leach, Satoh, and Cowan, there is likewise no suggestion or incentive that would lead one to expect that omitting the fly dust having the specific surface area properties required in Kurz, from the composition of Kurz, Leach, Satoh, and Cowan, would be expected to provide the desired pore density and free volume of the instant Claims, where Kurz

teaches that to omit this limitation of the fly dust component would *not* provide the desired properties in the composition of Kurz (adding fly dust renders previously unexpandable clays expandable, and further improves the expandability of expandable clays by twofold or more; see e.g., Kurz, Col. 4, lines 40-49). Kurz so modified, even in combination with Leach, Satoh, and Cowan, without fly dust having the specific surface area, therefore would be unsatisfactory for its intended purpose. The courts have held that "[i]f the proposed modification would render the prior art invention being modified unsatisfactorily for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984). The courts have also held that '[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious.'" *In re Ratti* 270 F. 2d 810, 123 USPQ 349 (CCPA 1959).

Nothing in Kurz modified with Leach, Satoh, and Cowan, therefore, suggests that the required pore density would be obtained as a result of combining these references, further modified so as not to include a fly dust having a specific high surface area, and therefore there is no suggestion to combine Kurz with Leach, Satoh, and Cowan, to achieve the desired pore density and free volume.

Therefore, the combination of Kurz with Leach, Satoh, and Cowan fails to disclose all elements of instant Claim 1, and fails to suggest a ceramic panel having the composition or properties claimed in Claim 1, and thus the combination does not render Claim 1 or its dependents unpatentable. Reconsideration and allowance of Claim 1 and its dependent claims is therefore respectfully requested.

Claim 16 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Kurz in view of Leach, Satoh, and Cowan, and further in view of Romanian Patent No. 114015 ("RO '015").

RO '015 fails to provide the missing limitations missing in the combination of Kurz in view of Leach, Satoh, and Cowan, and therefore modification of the combination with either Bergh or RO '015 fails to remedy the deficiencies of Kurz, Cowan, Leach, and Satoh as applied to Claim 1, from which Claim 16 depends. Therefore, the combination does not render Claim 1

or its dependents unpatentable. Reconsideration and allowance of the claims are therefore respectfully requested.

Therefore, the cited references, alone or in combination, fail to teach or disclose all limitations of the instant claims, and the combinations do not provide a teaching or suggestion that would motivate one skilled in the art to modify the references to provide the claimed invention.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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